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school system, a more enlightened rising generation will see the folly of the old popular belief.

It is not infrequent, nor is it unnatural, that a traveler, unacquainted with the South, is shocked when he or she sees the prevalence of snuff dipping among cotton-mill employees and rural tenants.

Snuff dipping and tobacco chewing by children are, however, such everyday observations with us in our work that they make little impression upon us. We view the habits as based upon a thoroughly rational explanation, traceable to conditions that existed years ago, and as dependent for their decrease upon a social evolution which involves an improvement in the sanitary life of hundreds of thousands of people. It will take at least a school generation to eradicate these widespread habits from among the rural school children of the South, and until the lives of these children are made happier by better sanitary surroundings we are not inclined to begrudge them the little happiness they seem to find in the use of snuff and tobacco, or to criticize them in the slightest for these habits.

THE RAT.

ITS HABITS AND THEIR RELATION TO ANTIPLAGUE MEASURES.

By R. H. CREEL, Passed Assistant Surgeon, United States Public Health Service.

The habits of the rat, on account of the rôle this rodent plays in the transmission of plague, are of the greatest interest. A thorough knowledge of the subject is a prerequisite in devising rat-proofing methods and in effecting a destruction of these animals. Much loose information has been circulated concerning the rat, which, being an animal of nocturnal habits, is not nearly so well known as the majority of people lead themselves to believe. In view of such conditions, experiments with rats have been performed at the San Juan quarantine station, simulating natural conditions as nearly as possible, and notations have been made bearing on the habits of the rat as observed under natural conditions and environment.

SWIMMING.

As the ability of the rat to swim concerns quarantine measures, attempts were made to ascertain how far and for how long a rat could swim, and to what extent it could orient itself while swimming at some distance from land.

The rodents were taken in cage traps to a point in San Juan Bay well away from the land, and released. Notes were made as to the tide and the water.

First experiment.—A full grown gray rat (*Mus norvegicus*) when released 1,200 feet from shore, swam for one hour and a half but apparently without sense of direction. The tide was ebbing at the rate of 2 miles an hour. The surface of the water was roughened by a fair breeze, but not choppy. The animal maintained its position against the tide, swimming fairly well, using the hind legs and tail, the fore legs being held close to the body and not being used. This rodent came from the residence district of San Juan, and presumably was wholly unaccustomed to the conditions to which it was subjected.

Second experiment.—A full grown gray rat (*Mus norvegicus*) was released 450 feet from the shore and swam to land in six minutes. The tide was favorable, the water smooth with a slight adverse breeze. This rat had been trapped in the swamp shrubbery in the vicinity of San Juan, and had adapted itself to semiaquatic habits.

Third experiment.—A full grown gray rat (*Mus norvegicus*) was released 1,300 feet from the shore, with an incoming tide and adverse breeze. The sea had a slight "wash" but was not choppy. The animal swam around rather aimlessly for 15 minutes; then apparently got its bearings and struck out for land, making the distance in 55 minutes from the time of its release. The total distance traveled was calculated at 1,500 feet.

Fourth experiment.—One full grown black rat (*Mus rattus*) and one full grown *Mus alexandrinus* were released 1,200 feet from land, with adverse tide and wind, the surface of the water being slightly roughened by the wind. The *Mus rattus* swam for 45 minutes, chiefly in an effort to maintain its position against the outgoing tide. The *Mus alexandrinus* survived 35 minutes. Both of these rodents, while using chiefly the hind legs and tail, at intervals also made use of the forelegs. Neither of these two animals seemed to have any sense of direction.

No observations were made as to the swimming ability of rats under natural conditions. It is known, however, that a large number of rodents frequent the swamp shrubbery and are well accustomed to swimming.

BURROWING.

First experiment.—Five full grown gray rats (*Mus norvegicus*) were placed within a stockade made of galvanized iron sunk into the ground 3 feet. The soil was quite firm. All five rodents commenced at once to burrow. Within 12 hours extensive excavations had been made. Within 48 hours these rat burrows were found to extend downward 2½ feet, branching out toward the center and circling the circumference of the stockade.

Second experiment.—Two full grown and two half grown black rats (*Mus rattus*) were placed in a stockade similar to the above. During three days they made no attempt to burrow, hiding themselves under tufts of grass.

Third experiment.—Two full grown black rats (*Mus rattus*) and two *Mus alexandrinus* were kept in the stockade three days, with the same result as indicated in experiment 2. There was no attempt to burrow. One hybrid, a cross probably between Alexandrinus and Norvegicus, made shallow excavations, sufficient only to hide its body.

Under natural conditions it has been noted in San Juan that the *Mus norvegicus* is essentially a burrowing animal, preferring to make excavations in the earth when it already has sufficient covert beneath flooring space. In the majority of instances the depth of the burrows would extend from one-half foot to a foot. The most extensive burrowing noted was in those cases where rats would choose as harborage a concrete floor unprotected by side walls. While the depth a rat will burrow under natural conditions has generally been observed as being not greater than one and a half feet, burrows have been noticed passing beneath walls of two-foot depth.

The gray rat (*Mus norvegicus*) apparently burrows with the greatest ease, even in the hardest ground, such as well-packed clay. The same species will pass through walls made of brick or irregular stones, provided the mortar is not composed of cement. Observations have been made of places where a *Mus norvegicus* has perforated walls of brick in which the construction was of sun-dried brick held together by sand and lime mortar. In some instances the rat run actually pierced the body of a brick, a smooth, well-beveled hole having been produced; more frequently, though, the wide interstices filled by a sand and lime mortar were the points perforated. Whether this operation was performed by burrowing or by gnawing can not be stated, but it was probably accomplished by gnawing. The English Plague Commission has credited the *Mus norvegicus* with the ability to gnaw through brick or concrete, but it is incredible that rodents can successfully attack concrete. No such instances have ever been noted in San Juan.

CLIMBING.

First experiment.—A full-grown Rattus, a full-grown Alexandrinus, and a full-grown Norvegicus were placed in a stockade surrounding the outer corner of a concrete building. None of these rodents was able to climb this outer corner.

A similar experiment was performed using an inner corner, with the same negative result.

Second experiment.—Full-grown rats of the three species were put in a stockade around a cocoanut palm. They climbed the tree with the greatest ease, but were not able to pass over a 12-inch band of zinc which encircled the trunk. The *Mus norvegicus*, however, jumped upward and outward to the top of the stockade, a distance of 17 inches.

Third experiment.—Full-grown rodents of the three species were put in a stockade surrounding a 1-inch standpipe, which they climbed with the greatest ease.

Observation of the climbing proclivities of rats under natural conditions makes it evident that the black rat and the Alexandrinus climb cocoanut trees to any height with facility for the purpose of obtaining food. Both of these species will likewise gain the upper story of a building by climbing pipes or wires, and will run from one building to another on wires. No observations have been made as to the climbing proclivities of the *Mus norvegicus* under natural conditions.

JUMPING.

As has been noted in one of the experiments above, a *Mus norvegicus* jumped upward and outward a distance of 17 inches. In several of the experiments, where Alexandrinus and Rattus were confined within a stockade, they often jumped upward a distance of 2 feet in their efforts to scale the stockade. In one instance a *Mus rattus*, confined within a perfectly smooth galvanized iron garbage can of 24-inch depth, by a series of jumps spiraled its way to the top of the can and escaped.

PREFERENCE FOR FOOD.

It has been said that the rat is an epicure. While this is hardly true, rats in different localities do show marked preference for certain articles of diet. A rodent that frequents a grain warehouse is most successfully trapped by use of grain as bait; those that frequent meat markets are similarly most successfully trapped in those places by using different kinds of meat for bait; and again, those rodents that are found in green groceries or where vegetables are kept are most easily captured by baiting the traps with vegetables. The use of cheese, the best known of all rat bait, is less effective in different classes of food depots than the food which the rat has been accustomed to. The sewer rat apparently easily accommodates himself to any class of diet.

Passed Asst. Surg. G. W. McCoy has made extensive observations on the bionomics of the rat as to its breeding or fecundity, and its endurance without food and water, so experiments and observation of this nature were not repeated.

CANNIBALISM.

The *Mus norvegicus* is very cannibalistic. Considerable trouble was encountered in maintaining a sufficient supply of these animals on account of their habits of killing and eating each other. Each morning it would be discovered that several rats had been killed during the night and partially devoured. The *Mus rattus* and *Mus alexandrinus*, while cannibalistic to a certain extent, are very markedly less so than the *Mus norvegicus*. The *Mus rattus* and *Mus alexandrinus* were kept separate from the *Norvegicus*, so that any antagonism of the species was not noted, but it is highly probable that the *Norvegicus* would have quickly destroyed the smaller species.

SUMMARY.

The *Mus norvegicus*, while essentially a burrowing animal and not addicted to climbing or swimming, is nevertheless quite capable of doing either. It burrows readily in the hardest earth, even to the depth of 2½ feet, and can pass through, probably by gnawing, all wooden material, soft brick, or mortar. The black rat and Alexandrinus (at least in Porto Rico) do not burrow at all, but are very adept at climbing or jumping, and therefore are the species chiefly found in the rural districts, removed from human habitations.

It is possible for rats to escape from ships anchored a quarter or even half a mile from shore and make a landing, the water being smooth and tide favorable. It is questionable whether rats under natural conditions would make the attempt, though unusual conditions aboard ship might determine this kind of migration.

RABIES.

A REPORT OF A CASE IN A CHILD AT ALEXANDRIA, VA.

By J. P. Leake, Assistant Surgeon, United States Public Health Service.

Cases of human rabies are sufficiently rare to justify the report of single instances, for only by the collation of the data of numerous observers can the variant symptomatology be clearly defined. The experience of one individual is hardly enough for the numerical method.

The present case was seen in consultation with Dr. Warfield and Dr. Hugh McGuire, of Alexandria, Va., and it is reported through their courtesy. The patient, a white boy aged 8, was bitten December 13, 1912, by a large bulldog whose identity is uncertain. The wound was a severe laceration of the right cheek, about 4 inches long, irregular, and reaching nearly to the corner of the mouth. It was cleaned, irrigated with corrosive sublimate solution, and sutured on the day of the occurrence. No abnormalities were noted in healing. On the evening of February 10, 1913—the sixtieth day after the bite—the child was taken sick with pain in the region of the wound and in the throat, some pain in the abdomen and left ear, and vomiting. Spasms on attempting to drink soon became pro-